

e-Science and the Grid – A UK Status Report

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J.C.R.Licklider's Vision

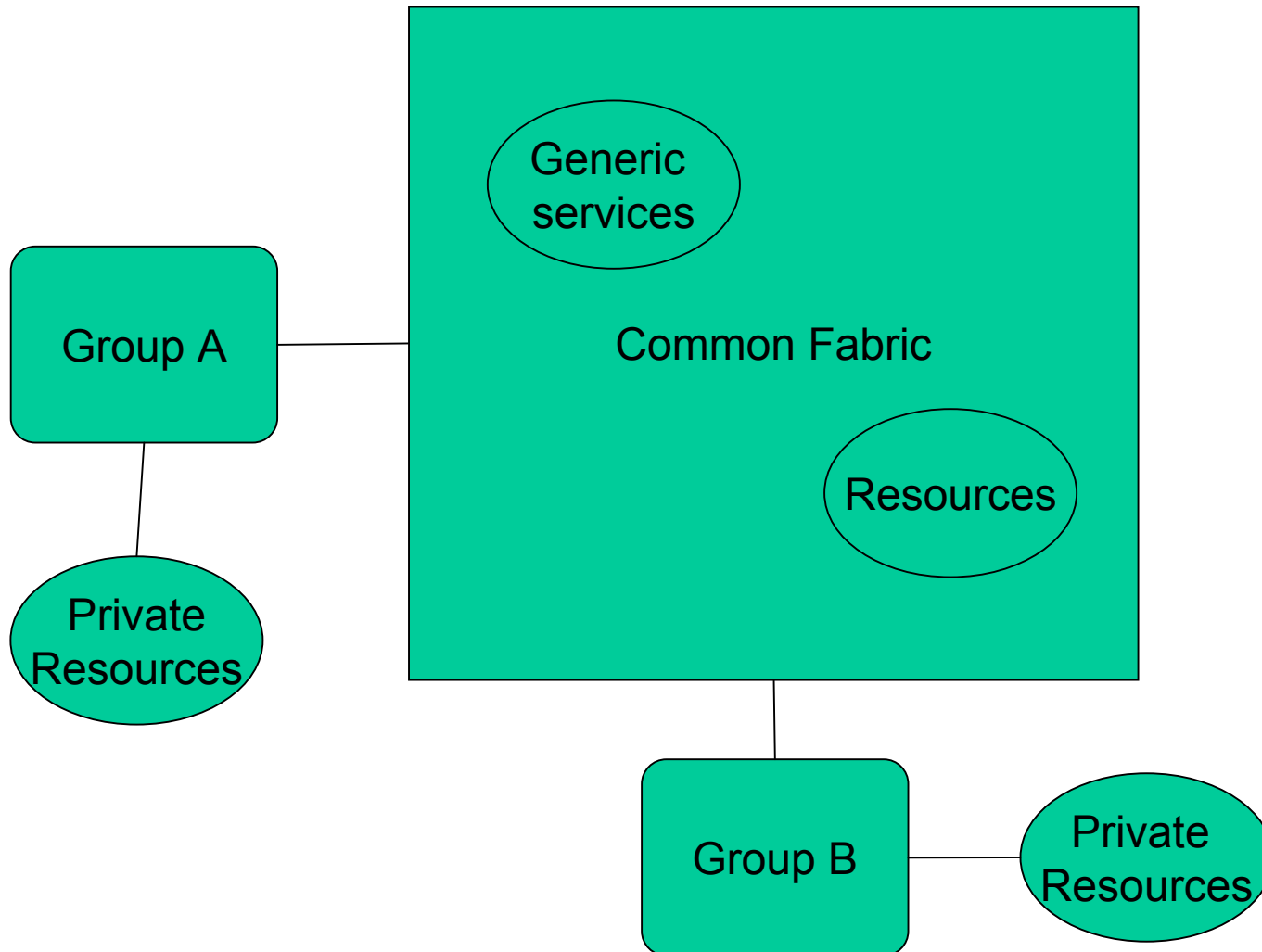
“Lick had this concept of the intergalactic network which he believed was everybody could use computers anywhere and get at data anywhere in the world. He didn't envision the number of computers we have today by any means, but he had the same concept – all of the stuff linked together throughout the world, that you can use a remote computer, get data from a remote computer, or use lots of computers in your job. The vision was really Lick's originally.”

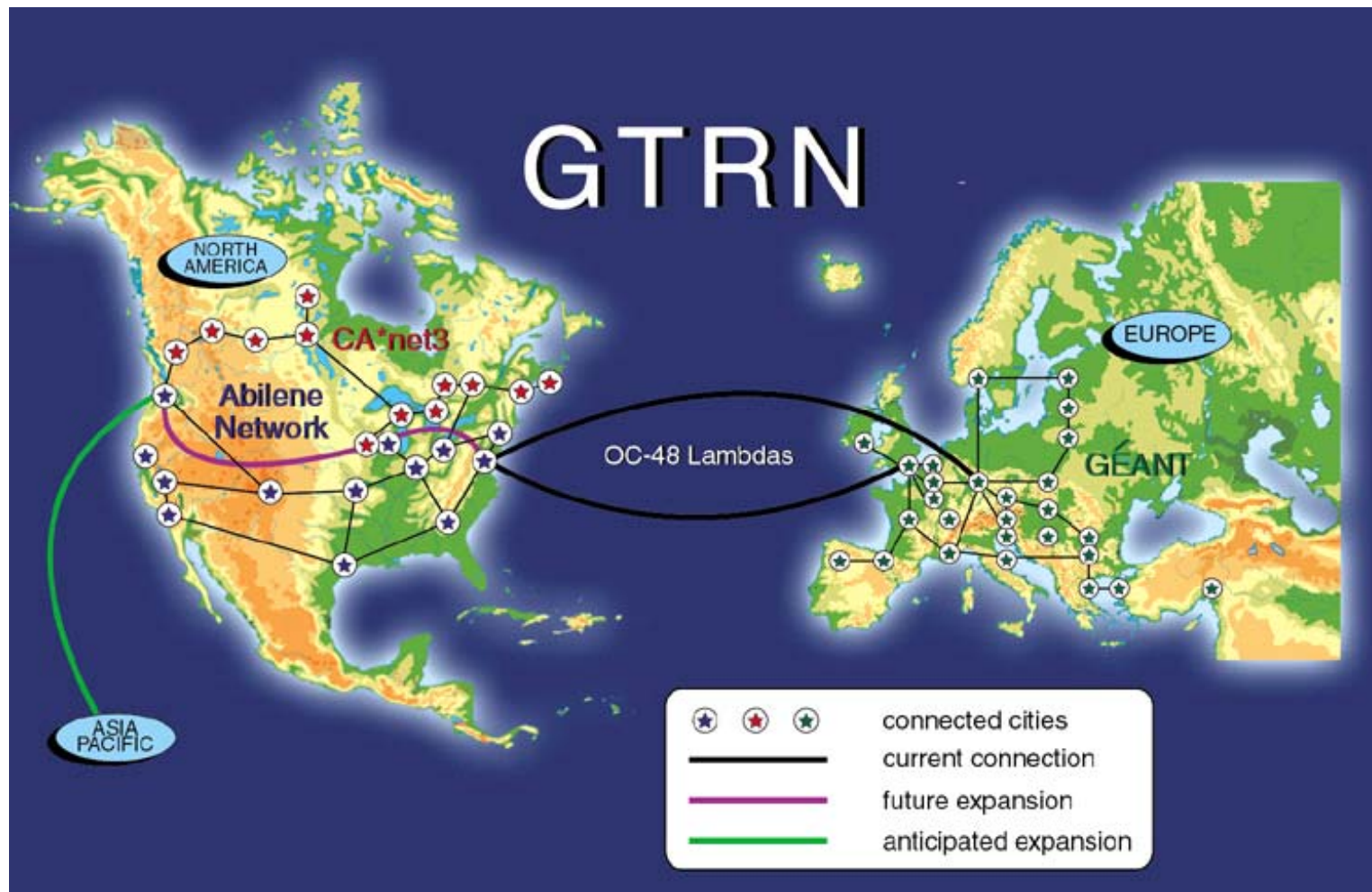
Larry Roberts – Principal Architect of the ARPANET

The e-Science Paradigm

- The Integrative Biology Project involves the University of Oxford (and others) in the UK and the University of Auckland in New Zealand
 - Models of electrical behaviour of heart cells developed by Denis Noble's team in Oxford
 - Mechanical models of beating heart developed by Peter Hunter's group in Auckland
- Researchers need to be able to easily build a secure 'Virtual Organisation' allowing access to each group's resources
 - Will enable researchers to do different science

e-Infrastructure/Cyberinfrastructure for Research





The Grid = A set of core middleware services running on top of high performance global networks

A Definition of e-Research

The invention and exploitation of advanced IT

- to generate, curate and analyse research data
 - From experiments, observations and simulations
 - Quality management, preservation and reliable evidence
- to develop and explore models and simulations
 - Computation and data at extreme scales
 - Trustworthy, economic, timely and relevant results
- to enable *dynamic* distributed virtual organisations
 - Facilitating collaboration with information and resource sharing
 - Security, reliability, accountability, manageability and *agility*

RCUK e-Science Funding

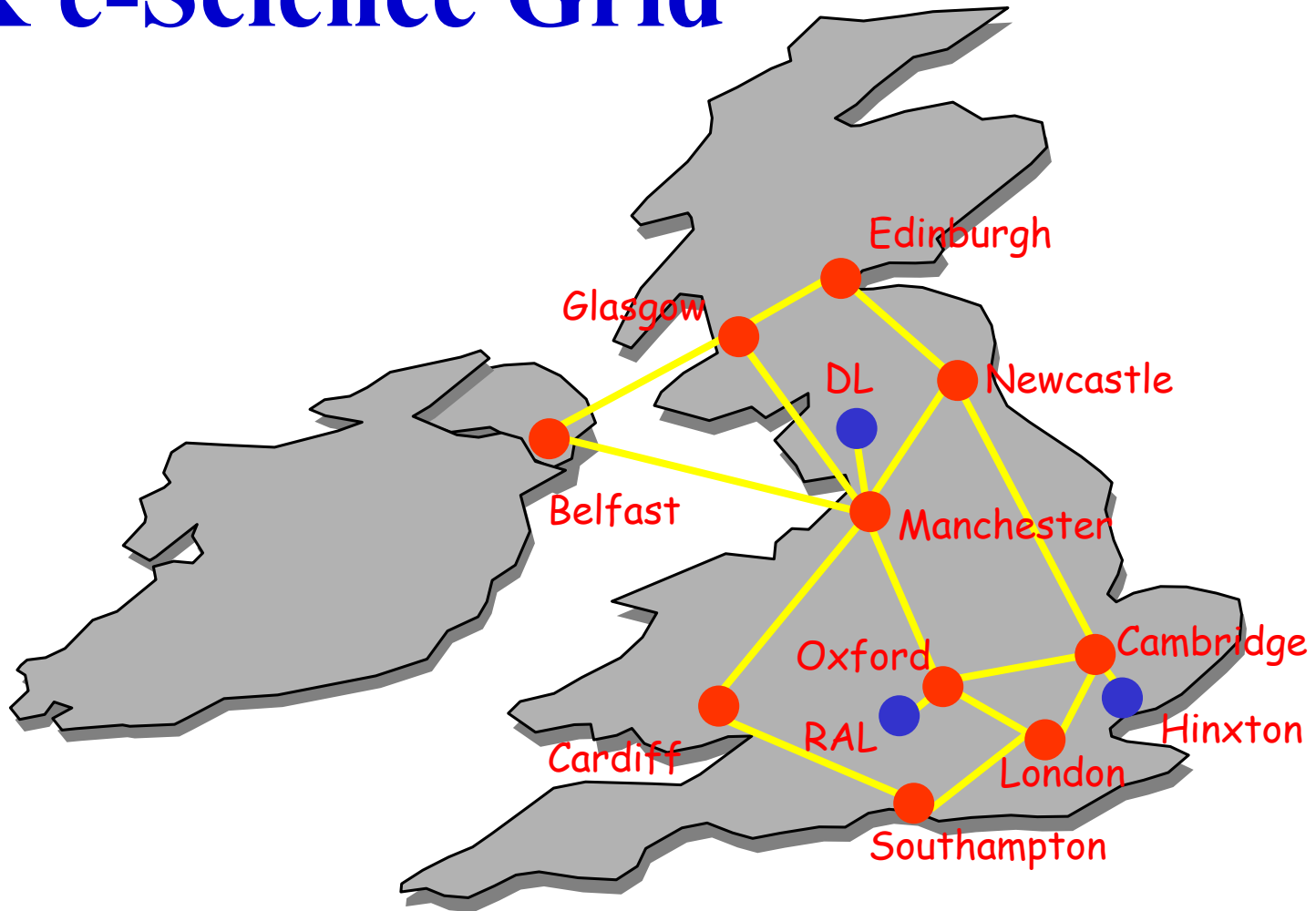
First Phase: 2001 –2004

- Application Projects
 - £74M
 - All areas of science and engineering
- Core Programme
 - £15M Research infrastructure
 - £40M Collaborative industrial projects

Second Phase: 2003 –2006

- Application Projects
 - £96M
 - All areas of science and engineering
- Core Programme
 - £16M Research Infrastructure
 - DTI Technology Fund

UK e-Science Grid



The UK e-Science Experience: Phase 1

- All Research Council e-Science funds committed
 - e-Science pilots launched covering many areas of science, engineering and medicine
- UK e-Science Core Programme
 - DTI £20M for collaborative industrial R&D
- About 80 UK companies participating
- Over £30M industrial contributions
 - Engineering, Pharmaceutical, Petrochemical
 - IT companies, Commerce, Media

UK e-Science: Phase 2

Three major new activities:

1. Deploy National Grid Service and establish Grid Operation Centre
2. Fund Open Middleware Infrastructure Institute for testing, software engineering and UK repository
3. Set up Digital Curation Centre to look at long-term data preservation issues

Grid Operation Centre

Deploy production 'National Grid Service'
based on four dedicated compute and data nodes
plus the two UK Supercomputers

- Develop operational policies, security, ...
- Gain experience with genuine users

Develop Web Services based e-Science Grid

- Work with EU EGEE project and NSF

Cyberinfrastructure Program

The UK Open Middleware Infrastructure Institute (OMII)

- Repository for UK-developed Open Source ‘e-Science/Cyber-infrastructure’ Middleware
 - Documentation, specification, QA and standards
 - Fund work to bring ‘research project’ software up to ‘production strength’
 - Fund Middleware projects for identified ‘gaps’
 - Work with US NSF, EU Projects and others
 - Supported by major IT companies
- Southampton selected as the OMII site

Digital Curation Centre (DCC)

- In next 5 years e-Science projects will produce more scientific data than has been collected in the whole of human history
- In 20 years can guarantee that the operating and spreadsheet program and the hardware used to store data will not exist
 - Research curation technologies and best practice
 - Need to liaise closely with individual research communities, data archives and libraries
 - Edinburgh with Glasgow, CLRC and UKOLN selected as site of DCC

The UK Dual Support System

- Provides two streams of public funding for university research:
 - Funding provided by the HEFCs for research infrastructure – salaries of permanent academic staff, premises, libraries & central computing costs
 - Funding from the Research Councils for specific projects – in response to proposals submitted & approved through peer review
- ‘Well Founded Laboratory’ concept
 - Extension for the Virtual Laboratory?

The Joint Information Systems Committee - JISC

Mission

To provide world-class leadership in the innovative use of ICT to support education and research

Context

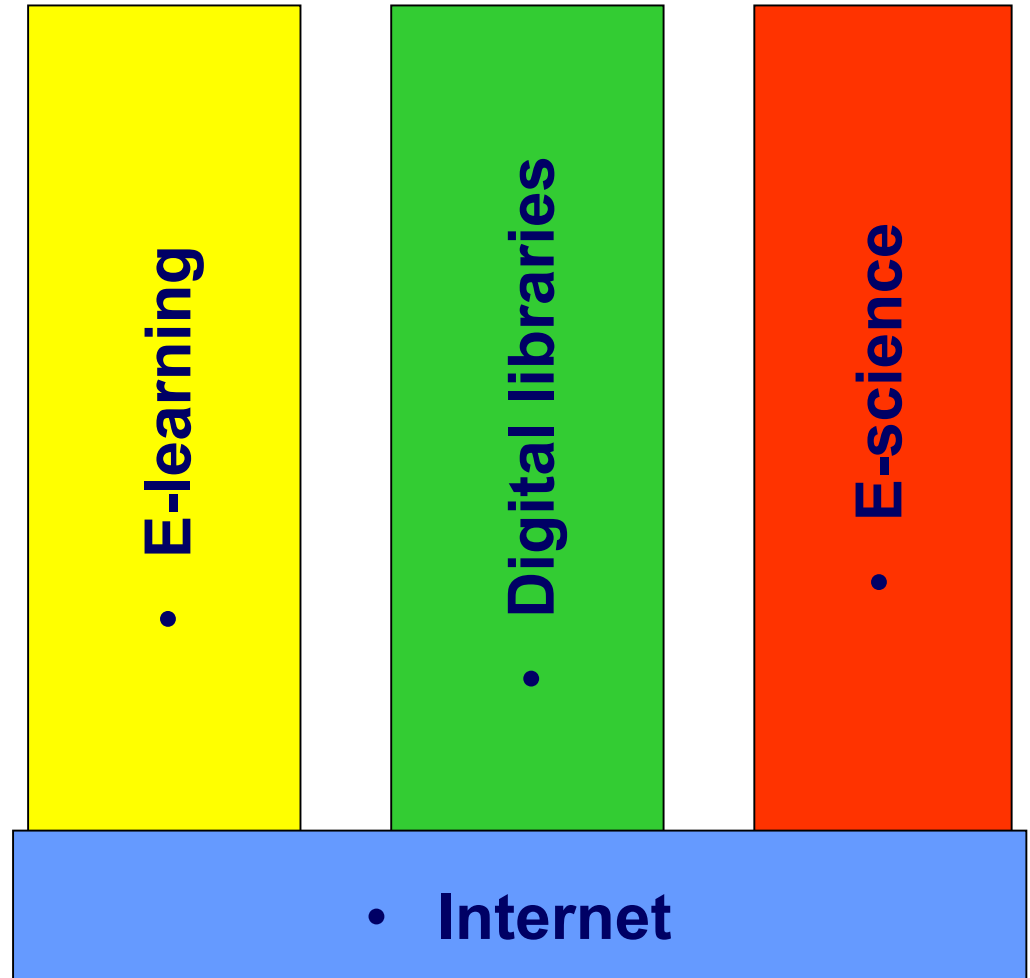
Information is a corporate asset and increasingly the knowledge base and intellectual assets of institutions and staff are in digital form

JISC Committee for Support of Research (JCSR)

- Established in 2002 after Follett Review
- Ensure JISC addresses the needs of the HE research community
 - Members representing each of the Research Councils plus the AHRB
- Recurrent budget of £3M p.a.
 - Strategy to co-fund some of the JCSR activities with other relevant funding bodies
 - Projects with BBSRC, CLRC, EPSRC, ESRC and the e-Science Core Programme

Current Status of Information Management for JISC Community

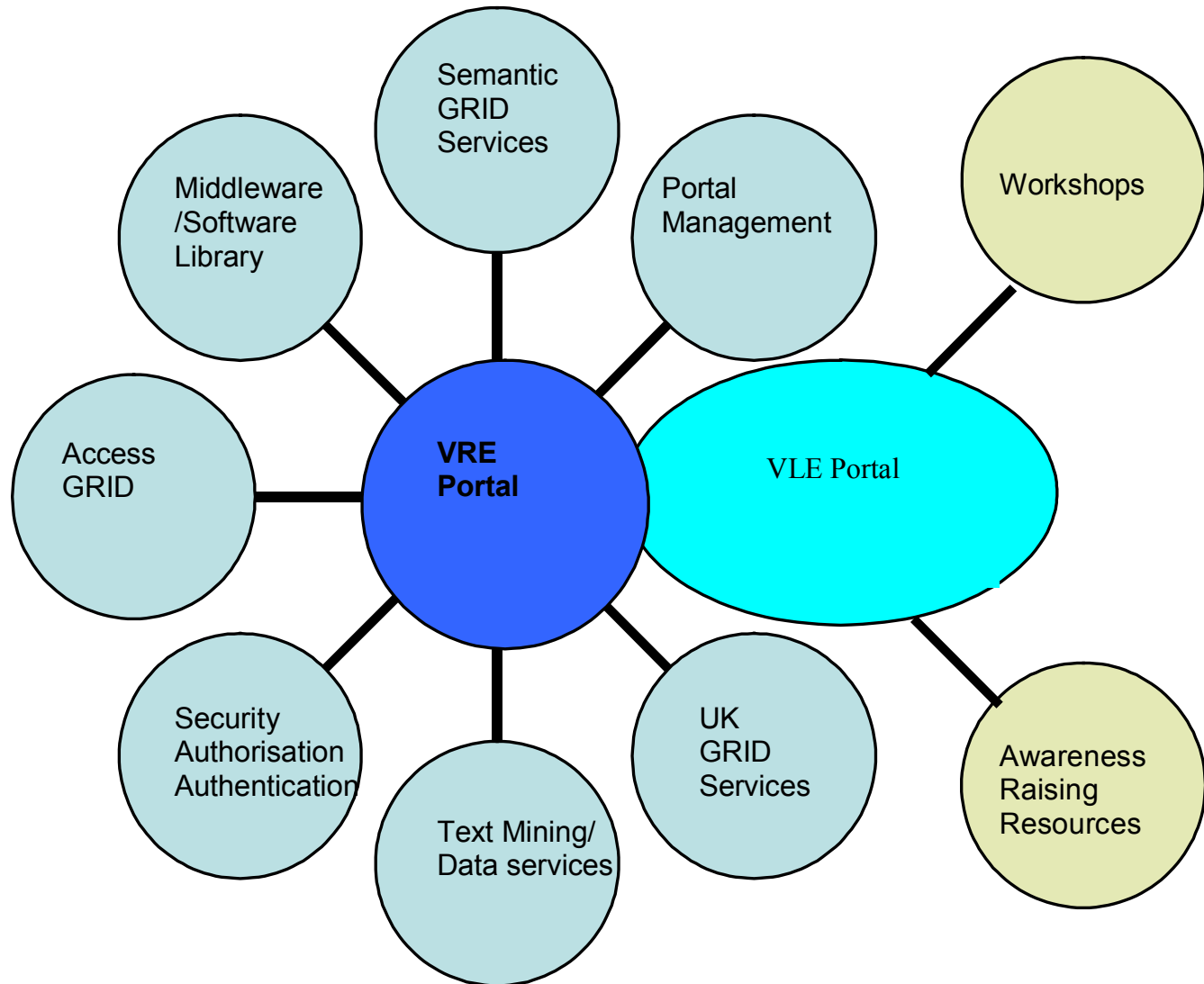
- Portals
- Applications
- Content
- Meta Data & Delivery tools
- Finding /Access tools
- AAA Services



New JCSR Funding

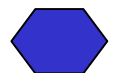
- £3M for Security Development Projects
 - Combine Shibboleth with PERMIS Authorization Services
 - Joint project with NSF Internet2 NMI project on Security Services for Virtual Organizations
- £3.4M for ‘National Middleware Services’
 - Deployment of National Authentication Framework based on Shibboleth
 - Support both Digital Library and e-Science communities

£3.4M JISC Programme for a Virtual Research Environment (VRE)





Local Research Equipment



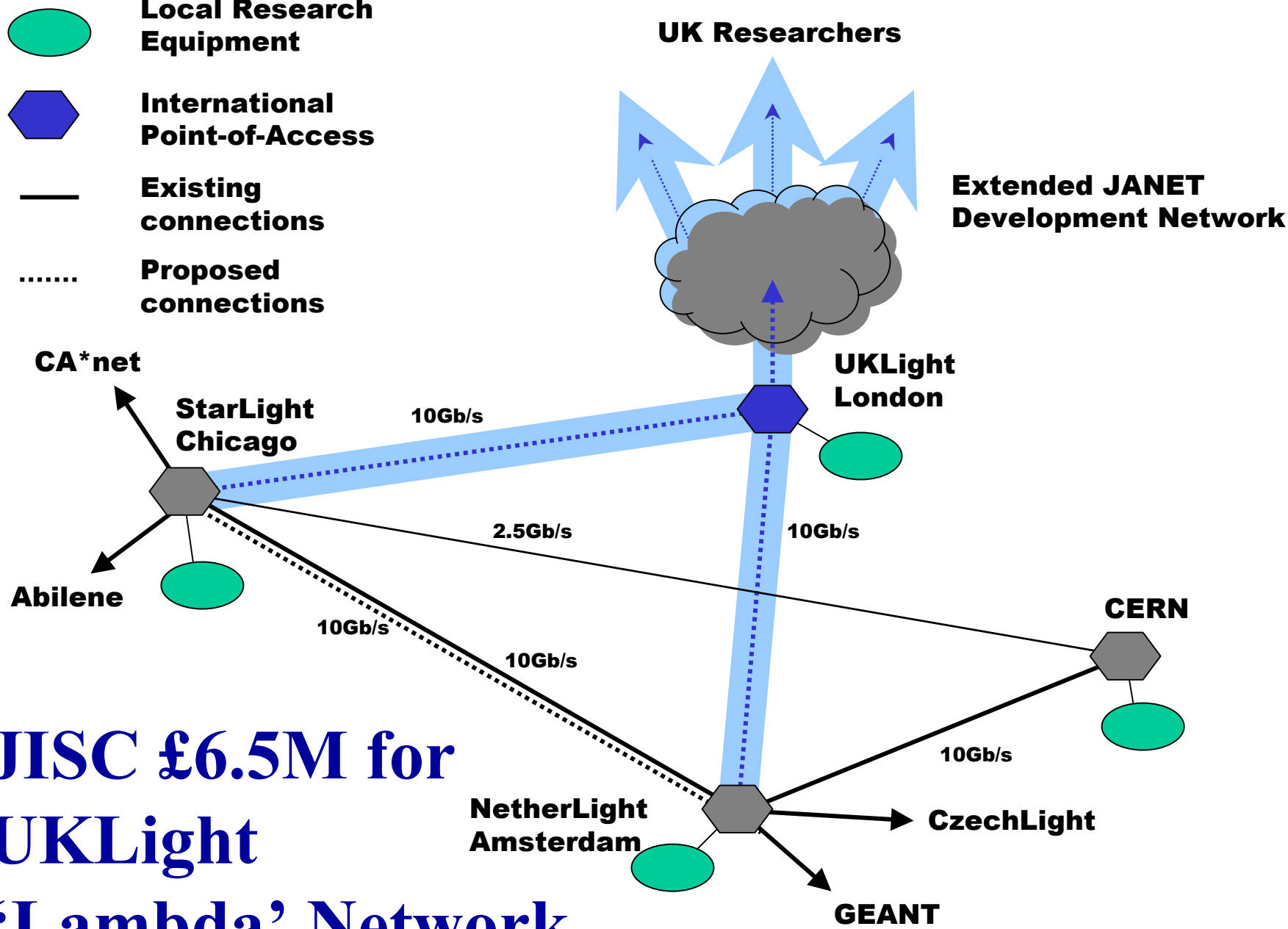
International Point-of-Access



Existing connections



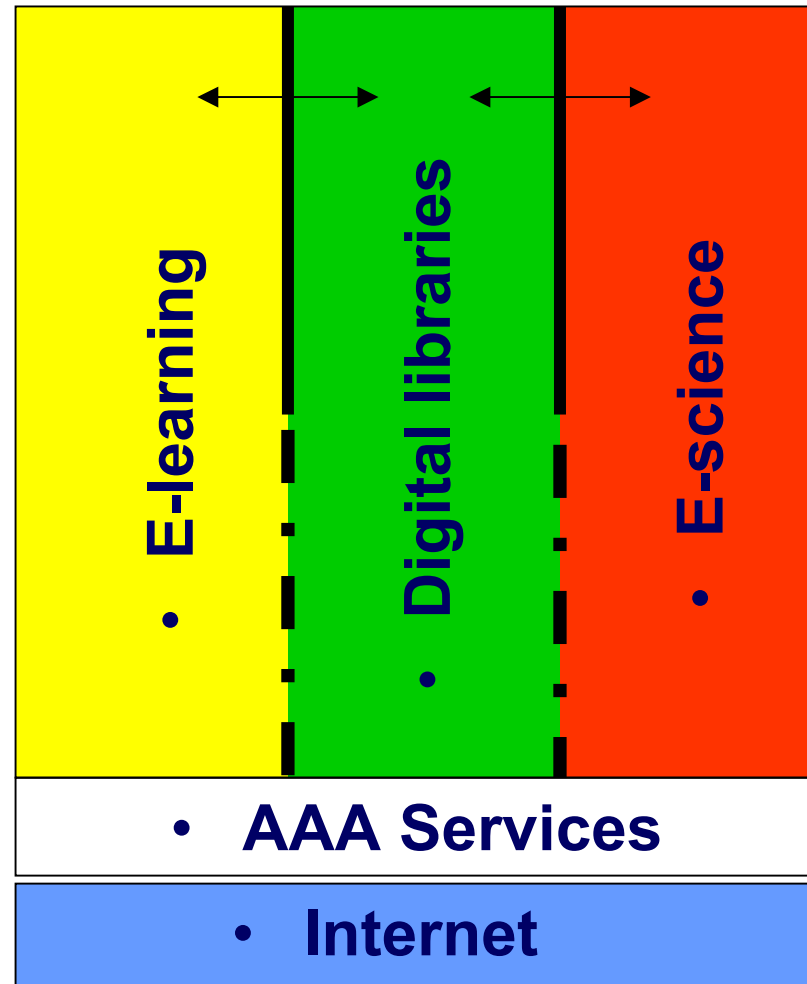
Proposed connections



**JISC £6.5M for
UKLight
'Lambda' Network**

How Far Can a Common Environment Go?

- Portals
- Applications
- Content
- Meta Data & Delivery tools
- Finding /Access tools



UK e-Science Timeframes

2001 2002 2003 2004 2005 2006 2007

SR2000

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SR2002

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SR2004

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SJ5/AAA Service

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LHC/LCG

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UK National Grid Service

- From April 2004, NGS offers free access to two 128 processor compute nodes and two data nodes
- Initial software is based on GT2 via VDT and LCG releases plus SRB and OGSA-DAI
- Plan to move to Web Services based Grid middleware by April 2005
- Need for resource allocation mechanisms
 - Accounting, Performance Prediction

Computational Markets Project

- UK Core e-Science Programme project
- Interfaces & protocols to trade Grid Services
- Funded by Department of Trade & Industry
- Collaborators
 - London e-Science Centre (LeSC)
 - e-Science North West (ESNW)
 - Southampton e-Science Centre (SeSC)
 - UK Grid Support Centre



Practical Demonstrators

- Engineering Optimisation
 - Paying for meshing services
- Buying Compute Resources
 - Brokering within and between organisations
- Managing Access to Instruments
 - Buying time on telescopes

Performance-managed Grid Middleware Project

- Funded by / collaborating with
 - UK e-Science Core Programme
 - IBM (Watson, Hursley)
 - NASA (Ames), NEC Europe, Los Alamos National Laboratory, MIT
- Aims
 - Integrate established performance and scheduling tools with emerging grid middleware
 - Test on scientific and business case studies

Report on Grid Performance

- Workshop sponsored by the JCSR
- Output required by JCSR is report on Grid Performance
 - Should emphasize ‘development’ activities rather than ‘research’
 - Can cover performance tools
 - Could give guide to ‘best practice’
 - Should highlight ‘gaps’ that need to be filled